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# PRESIDENCY UNIVERSITY

BENGALURU

## Make Up Examinations – December 2025

Date: 26 – 12- 2025

Time: 9:30am – 12:30pm

<b>School:</b> SOE	<b>Program:</b> B. Tech		
<b>Course Code:</b> ECE3016	<b>Course Name:</b> Electronic Controlled Converter		
<b>Semester:</b> MK	<b>Max Marks:</b> 100	<b>Weightage:</b> 50%	

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	15-20	20-25	20-25	20-25	20-25

### Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.

### Part A

Answer ALL the Questions. Each question carries 2marks.

10Q x 2M=20M

1.	There are four power semiconductor devices namely SCR, TRIAC, IGBT, IGCT. Name the device that can carry current in both the direction, when required gate pulse is applied	2 Marks	L1	CO1
2.	The power electronic converter introduces conducted electromagnetic interference (EMI) into the source, load, and neighbouring systems while transforming one type of energy into another. Could you offer at least one potential way to get rid of conducted electromagnetic interference?	2 Marks	L1	CO1
3.	In half-wave controlled rectifier the average output voltage is given by the equation $V_{oav} = \frac{V_m}{2\pi} (1 + \cos \alpha)$ what is the average output voltage equation if you replace an SCR by a power diode considering resistive load?	2 Marks	L2	CO2
4.	When converting AC power to controlled DC power, the full-wave controlled rectifier circuit is utilised to increase efficiency to a level comparable to that of a half-wave controlled rectifier. If you connect a capacitor with a large enough value across the resistive load in the circuit of a full-wave controlled rectifier, can you get a controlled output?	2 Marks	L2	CO2

5.	By regulating duty cycle ( $K$ ) between 0 and 1, the Buck converter or step-down chopper circuit transforms fixed DC voltage into variable DC voltage. Could you recommend a good way to calculate the chopper's effective input resistance in terms of $K$ while taking into account the ideal chopper (the voltage across the switch while it is ON is 0V)?	2 Marks	L2	C03
6.	Let's look at an example where a DC motor with an $E_b$ back emf is linked across the output of a step-up chopper or boost converter circuit with a $V_s$ input voltage. Describe the prerequisite that must be met in order for Boost to function.	2 Marks	L2	C03
7.	In order to achieve a square wave output voltage across the output, the full-bridge inverter must be run in square wave mode. If the inverter's battery voltage is 24V, what is the inverter's output voltage at root mean square?	2 Marks	L2	C04
8.	One kind of power electronic converter that changes fixed DC power into variable AC power is an inverter. Why are GTO devices not favoured over MOSFETs or IGBTs in the circuit of a complete bridge voltage source inverter?	2 Marks	L2	C04
9.	Using a single triac device or two SCRs coupled back-to-back, the single phase bidirectional AC voltage controller regulates power flow in both the positive and negative half cycles. Could you recommend the bare minimum of SCRs and diodes required to provide bidirectional AC power flow control?	2 Marks	L2	C05
10.	The lack of a common cathode is a disadvantage of a single phase bidirectional AC voltage controller with two SCRs linked in an anti-parallel topology. How can a common cathode be achieved without a triac device?	2 Marks	L2	C05

## Part B

### Answer the Questions.

Total Marks 80M

11.	a.	According to theory, a class-E chopper can be used in all four quadrants to rotate a DC motor in the following modes: forward (first quadrant), forward regenerative braking (second quadrant), reverse (third quadrant), and reverse regenerative braking (fourth quadrant). Could you describe the process of using a class-E chopper to achieve the functionality of a class-A chopper (Buck converter) using the required equivalent circuit and related waveforms?	08 Marks	L3	C03
	b.	Both thyristor pairs' firing angles are taken to be equal in a single phase fully regulated rectifier. A high value of $L$ will cause the load to have a constant, continuous current. A discontinuous load current will result from a modest value of $L$ . The firing angle for the aforementioned converter must be between 0 and less than 90 degrees for rectification mode and between 90 and 180 degrees for inversion mode in order to function. Sketch output voltage and output current waveforms for rectification mode and inversion mode, assuming an appropriate firing angle.	12 Marks	L3	C02

Or					
12.	a.	Switching pulses must have a 50% duty cycle to activate diagonal switches (Q1 and Q2) in order to operate a single phase full bridge inverter in square wave mode. Complementary switching pulses are necessary to activate Q3 and Q4 switches. The basic component's rms value is highest when a square wave is obtained at the inverter's output, but it contains all of the harmonics. Create the proper plan to produce single pulse width modulated switching pulses for inverter switching, allowing for the elimination of specific harmonics to enhance the inverter's harmonic profile. Considering three pulses every half cycle, write an expression for the rms output voltage for multiple pulse width modulation.	10 Marks	L3	CO4
	b.	Determine the (a) firing angle, (b) average output current, and (c) average output voltage if the single phase half wave regulated rectifier is powered by a 120V, 60 Hz supply with a resistive load of $R = 20 \text{ ohm}$ . If the average output voltage is 40% of the highest possible average output voltage, Average output voltage (d) rms output current (e) rms output voltage	10 Marks	L3	CO2

13.	a.	When the step-down chopper is turned on, its voltage drop is $V_{ch} = 1V$ , its chopping frequency is $f = 10\text{kHz}$ , and its resistive load is $R = 37 \text{ ohm}$ with an input voltage of $V_s = 120V$ . If 50% is the duty cycle calculate the following: (a) chopper efficiency; (b) rms output voltage; (c) effective input resistance; and (d) average output voltage.	10 Marks	L3	CO3
	b.	The input and output voltages of a step-up chopper are 200 and 300 volts, respectively. if the chopper's non-conducting time is $5\mu\text{s}$ . Determine the pulse width. For constant frequency operation, the pulse width can be split into two equal portions. Determine the output voltage that has changed.	10 Marks	L3	CO3

Or					
14.	a.	The input voltage of the single phase full wave AC voltage controller is $V_s = 100V$ , 50 Hz, and the resistive load is $R = 6.5 \text{ ohm}$ . Determine (a) the rms output voltage (b) the input power factor (c) the average current of the T1 thyristor (d) the rms current of the T1 thyristor. The delay angles of the thyristors T1 and T2 are equal, $\alpha_1 = \alpha_2 = \alpha = (\pi)/4$ .	08 Marks	L2	CO5
	b.	Determine (a) the rms output voltage, (b) the rms value of the fundamental component, (c) the output power, (d) the average current of each device, (e) the peak device current, and (f) the reverse blocking voltage of each device for a single phase full bridge inverter with a resistive load of $R = 27 \text{ ohm}$ and dc input voltage $V_s = 36V$ .	12 Marks	L2	CO4

15.	a.	Two SCRs linked in anti-parallel fashion make up the circuit of a single phase bidirectional AC voltage controller. Is it possible to alter the circuit so that a single SCR can regulate power flow in both the positive and negative half cycles?	10 Marks	L3	CO5
	b.	What happens if one of the two thyristors in a single-phase semi-converter-controlled rectifier circuit is swapped out for a diode? Use a representative output voltage waveform over a resistive load to support your response.	10 Marks	L2	CO2
<b>Or</b>					
16.	a.	What prerequisite must be met for power to flow in both directions in a helicopter? Which chopper requires the fewest regulated switching mechanisms to allow electricity to flow in both directions? Create the proper circuit diagram.	10 Marks	L2	CO3
	b.	The half wave regulated rectifier has a delay angle of $\alpha = \pi/4$ and a purely resistive load of R. Calculate (i) $\eta$ (ii) FF (iii) RF (iv) TUF (v) PIV	10 Marks	L2	CO2
17.	a.	Determine (a) the rms output voltage, (b) the rms value of the fundamental component, (c) the output power, (d) the average current of each device, (e) the peak device current, and (f) the reverse blocking voltage of each device for a single phase half bridge inverter with a resistive load of $R = 11 \text{ ohm}$ and dc input voltage $V_s = 100\text{V}$ .	12 Marks	L2	CO4
	b.	How do you derive an expression for (i) Average output voltage (ii) RMS output voltage (iii) Chopper efficiency (iv) Effective input resistance for the buck converter that has a resistive load.	08 Marks	L3	CO3
<b>Or</b>					
18.	a.	In order to link a 24V dc supply across a relay coil with a dc resistance of $12 \Omega$ , $\beta = 35$ to $80$ , $V_{CE(sat)} = 0.3\text{V}$ , and $V_{BE(sat)} = 0.8\text{V}$ , a transistor switch is utilised. To activate the transistor, an input pulse with a duty cycle of 50% and a voltage range of 0 to 5V is delivered to the base via RB. Determine (i) RB to get an ODF of 5, (ii) $I_{C(sat)}$ , and (iii) the transistor's power loss during the saturation stage.	12 Marks	L3	CO2
	b.	The input voltage of the single phase unidirectional AC voltage controller is $V_s = 100\text{V}$ , 50 Hz, and the resistive load is $R = 35 \text{ ohm}$ . Determine (a) the rms output voltage, (b) the input power factor, (c) the average current of the T1 thyristor, and (d) the rms current of the T1 thyristor. The delay angles of the T1 thyristors are $\pi/6$ .	08 Marks	L3	CO5